Remarks/Arguments

The specification is being amended to correct minor errors therein and to provide conformity between the specification and the drawing. In addition, Fig. 1 has been amended to include the reference numeral 130, which appears at page 4, line 3 of the specification.

Claims 12-16, 18-20 and 23 stand rejected, 35 USC 103(a), as unpatentable over Kracht patent 6,377, 987 in view of Cudak patent 6,058,106, and claims 17, 21, and 22 stand rejected, 35 USC 102(e), as being anticipated by Kracht. In response thereto applicants are amending claims 12,16,17, 20, 21, and 22 and canceling claims 13-15 and 19.

Before discussing the lack of relevance of the Kracht disclosure and teaching to applicants' invention a difficult problem of terminology must be addressed. As the Examiner knows there are multiple service layers on a protocol stack, including the hardware layer 1, the SONET, ATM, or Ethernet layer 2, and the IP layer 3. While Kracht refers to his system as determining the "physical" topology of a network, in fact his system does not and can not automatically determine the actual physical topology, that is, the hardware layer of the final wires and connections in the network that are below the IP layer.

Applicants urge the Examiner to review the Background section of applicants' specification wherein the prior art methods for updating a network topology database, including the methodology taught by Kracht, is set forth. As stated at page 2, lines 7, the prior methods for updating the network topology database relied on manual operations, whereby a craft person makes the connection and enters it into a network management system (NMS) database. While "IP auto-discovery functionality" allows a network management system operating in the IP domain to construct the topology of the IP network by simply communicating with the network elements in the network" (page 3, lines3-6) such auto-discovery functionality prior to applicants' invention has not been available for optical equipment operating at the physical layer, that is, at layers below the IP layer. Contrary to Kracht, applicants' invention operates at the lowest layer whereby all physical network elements of the network can be automatically discovered. Operating at the IP and higher levels, as Kracht does, does not provide such automatic discovery of the unknown physical elements.

Kracht, contrary to the Examiner's statement, does not teach a method for realizing the physical layer topology of a network. Both applicants and Kracht are concerned with what, to use Kracht's term, are "black cloud devices". Although Kracht entitles his Secton 8 (at column, 14, line 36 et seq) as "Generating Physical Link Information", the section does not address the issue of discovering port-to-port wiring of black cloud devices at all. Rather, it discusses how, once this topology is discovered through the prior art manual techniques, it is relayed by an SNMP agent on the device to the NMS, where it is displayed on a GUI. However, applicants' invention specifically does not use such manual inputs.

The problem to which applicants' invention is directed is that of a telephone company, where transmission cross-connect equipment supporting multiple protocols (e.g., ATM, SONET, DSO/T1/T3, WDM, and not IP) is installed on a daily basis. Each of these devices may have thousands of ports and corresponding numbers of physical connections to other equipment. It is the manual effort of accurately entering this information into a NMS database, and subsequently tracking changes, that applicants' invention saves. Kracht's system involves auto-discovery of an IP-based Internet that has already been installed, one in which devices have established IP addresses, one for each port. The black cloud devices Kracht speaks of are exceptions in an IP-visible network and whose presence is inferred by, at best, two heuristics, described by Kracht with reference to his Fig. 6. However, the Kracht method, therein described, could guess at possible connections from devices to a black cloud device, but it would have no more information. It would have no idea that the devices 602,604, and 606 are actually connected by black cloud device 608. But that is precisely the actual physical topology detail that a central office craft person needs to know in order appropriately for the telephone company to provision the equipment.

In item 9, the Examiner has referred to Kracht col.14, lines 16-35, for the teaching that the "physical layer auto discovery is at the lowest layer in the stack, in order to be able to discover elements within all high-layered protocol domains."

Kracht, at column 6, line 13, states "Layer 2 and layer 3 configuration information is gathered from the group of devices". Following this, Kracht's explanation for how this is done relies on:

seeing a MAC address on the line (col. 13, lines 28-39);

inferring a black cloud device from port numbers (col. 13, lines 1-26); and

having IP-visible devices on the IP network, where these devices actively send their presence to the NMS using the IP protocol.

However, the MAC address method is completely insufficient because it does not work with line protocols other than Ethernet, as, among other reasons, the MAC address only appears on an Ethernet packet header. The method of inference for black cloud devices is insufficient because, as discussed above with reference to Kracht Fig. 6, it is non-deterministic and misses a huge amount of information with respect to multiple devices, wiring, and port number connectivity. Finally, the method described by Kracht in col. 6, lines 6-68, uses SNMP/TCP/IP, which are layer 5, 4, and 3 protocols. Kracht's method does not use auto-discovery at a layer below the IP layer, as in applicants' invention.

With respect to the Examiner's specific reference to Kracht col. 14, lines 16-35, the material therein talks about "stackable devices", such as the Model 1502 and 1503 Microhubs. The "stackable" term means that two or more such Ethernet hubs can be combined to make one large hub. It has nothing to do with discovery at the lowest layer in the protocol stack. In fact, the method Kracht describes in col. 14, lines 16-35, is simply further elucidation of using SNMP/TCP/IP, which is layers 5,4, and 3.

In contrast, by using a layer below the IP layer, applicants' invention can cause the hardware on line cards to send bits independently over the fiber or copper wire. This makes applicants' Far End Protocol independent of what the final payload carrying layer 2 protocol used on the wire will be, whether SONET, Ethernet, DS0, DS1, or DS3.

In rejecting claim 22, the Examiner had cited Kracht col. 7-col 8, line 60 as disclosing electronically storing the serial number and model number of the network elements. Applicants have amended claim 22 to recite the storing of a pairs of strings consisting of the equipment's model number and serial number. World-wide, for each network element this pair of strings will create a unique identifier, which is not dependent on the addressing scheme or any protocol, thereby being protocol-independent. Applicants fail to find in the material cited by the Examiner any mention or suggestion of this use of a pair of strings electronically stored. Kracht col. 7, lines 55-65 talks about using a software variable, sysObjectId, in a SNMP MIB. SNMP operates over TCP/IP. Respectively, these are layer 5, 4, and 3 protocols. The method described by Kracht depends on an IP address to identify the equipment. This, however, would be useless, for example, in discovering the topology of voice equipment.

Applicants submit that their invention has filled a long felt need in the provision operations of telephone companies which desire to know all the details of the physical topology of devices at the lowest layer. It has accomplished this by going outside of traditional notions of a protocol stack and sending topology information in applicants' Far End Protocol over the raw fiber or copper wire, independent of the protocol stack on that wire. Merely using the teaching of Kracht or attempting to extend it in some unknown way would not result in a method for the discovery of the actual physical topology on links that do not have IP or the wiring for transmission cross-connect devices that support different protocol stacks on different links.

Turning now to the claims, applicants submit that there is no suggestion or teaching by Kracht or other prior art of realizing the topology of a network below the IP layer by the steps and apparatus recited in the claims, as amended, including operating at a layer below the IP layer which, as recited in claims 20 and 23, is the lowest layer in the protocol stack.

Reconsideration and allowance of claims 12, 16, 17, 18, 20, 21, 22, and 23 are therefore respectfully requested.

It is believed that this application is now in condition to be passed to issue, and such action is also requested. However, if the Examiner deems it would in any way expedite the prosecution of the application she is invited to telephone applicants' attorney at the number set forth below.

Respectfully submitted,

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